This is the authors' pre-publication version for the article that can be found in *Pacific Conservation Biology:*

Clement, S, Moore, SA, Lockwood, M, & Morrison, TH. 2015. A diagnostic framework for biodiversity conservation institutions. *Pacific Conservation Biology,* 21(4): 277-290. http://dx.doi.org/10.1071/PC15032

A diagnostic framework for biodiversity conservation institutions

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Abstract

Biodiversity loss is a critical issue on the environmental agenda, with species-based approaches failing to stem the decline. Landscape-scale approaches offer promise, but require institutional change. This article describes a novel conceptual framework for

assessing institutional arrangements to tackle this persistent problem. In doing so, two critical issues for biodiversity governance are addressed. The first is a need to enrich largely theoretical descriptions of adaptive governance by considering how the practical realities of institutional environments (e.g. public agencies) limit achievement of an adaptive governance 'ideal'. The second is enabling explicit consideration of the unique aspects of biodiversity as a 'policy problem' in the analysis of institutional arrangements. The framework contributes to efforts to design more adaptive institutional arrangements, through supporting a more sophisticated and grounded institutional analysis incorporating insights from institutional theory, especially literature on organizational environments and public administration. Concepts from Pragmatism also contribute to this grounding, providing insight into how public agencies can play a more productive role in biodiversity conservation and building public consent for management actions. The diagnostic categories in the framework include the attributes of the biodiversity problem and the involved players; the political context; and practices contributing to both competence and capacity. Guidance on how to apply the framework and an example of its application in Australia illustrate the utility of this tool for institutional diagnosis and design. Development of this diagnostic framework could be further enhanced by empirically-informed elaboration of the relationships between its components, and of the nature of and factors influencing key concerns for adaptation, particularly learning, self-organizing and buffering.

Keywords: biodiversity, adaptive governance, diagnostic, institutions, adaptation, resilience, Pragmatism

Acknowledgement
This research is an output from the Landscapes and Policy Research Hub. The hub is supported through funding from the Australian Government's National Environmental Research Program and involves researchers from the University of Tasmania (UTAS), The Australian National University (ANU), Murdoch University, the Antarctic Climate and Ecosystems Cooperative Research Centre (ACE CRC), Griffith University and Charles Sturt University (CSU).

1. Introduction

Biodiversity has been dramatically modified by human activities, and its decline continues at a rapid rate (Butchart *et al.* 2010). Though the term was coined only a few decades ago, conservation of biodiversity has secured a place on the global environmental policy agenda. Commitment to conserve biodiversity is now formally reflected in a large, complex set of institutional arrangements at multiple levels of governance. Yet despite significant efforts to slow biodiversity loss, declines continue as pressures on ecosystems increase. Like other 'wicked' policy problems, governance systems struggle to cope with the ill-defined problem boundaries and the diverse ways in which facts, values, and interests come together to frame policy-making (Brennan 2004; Head 2014).

Biodiversity loss is a multi-scalar problem, as are the drivers of its decline. Climate change, land use change, and invasive species are major causes of biodiversity decline; and all occur at multiple spatial and temporal scales and cross economic sectors, political portfolios, property tenures, and jurisdictions (Nelson *et al.* 2006). Authority, capacity, and responsibility for biodiversity conservation thus do not lie with a single, central entity. Enormous potential exists to achieve better conservation

outcomes through appropriately designed institutions. Institutions and governance regimes can influence the trajectory of ecosystems (Chaffin *et al.* 2014), making them critical in achieving biodiversity objectives. Institutions are the sets of rules, norms and strategies that shape human behavior and provide structure, stability, and meaning to social life (Scott 2014). Governance is the process by which institutions are formed, applied, interpreted, and reformed (McGinnis 2011a).

Institutions can build adaptive capacity, actively steer policy and systemic change, and help prepare for system transformation (Koontz *et al.* 2015). While they make action to conserve biodiversity possible, they can also be ineffectual or even exacerbate decline. Despite several decades of formal policies targeting biodiversity, global extinction rates are estimated to be more than 1,000 times the background rate and increasing (Pimm *et al.* 2014). Institutional reform is needed to stem this decline.

Researchers have called for adaptation and even transformation of existing institutional arrangements to address policy failure (Hill *et al.* 2013). Implementing this change is difficult, given the enormous challenge of designing something that resists rational design. Institutions provide stability to social life, but they exhibit a strong status quo bias (Goodin 1996) and understanding of the pathways to change is incomplete (Weible *et al.* 2012). Adaptive governance is one promising reform strategy, defined as a family of governance approaches focused on building the skills to cope with environmental change and uncertainty through experimentation and learning (Paavola *et al.* 2009; Brunner 2010). Ideally, an adaptive governance system consists of multi-layered governance networks with institutions that foster learning,

build social capital, and link across vertical and horizontal scales; polycentricity; and deliberative decision-making (Dietz *et al.* 2003; Folke *et al.* 2005; Armitage *et al.* 2012). Often contrasted with traditional, centralized, efficiency-driven approaches that aim to reduce uncertainty and complexity, adaptive governance aims to build the capacity to cope with these inherent characteristics of linked social-ecological systems (SESs) (Chaffin *et al.* 2014).

Attention to the notion of institutional fit is a particularly useful feature of adaptive governance scholarship (Armitage *et al.* 2012), which adopts the principle of tailoring institutions to the spatial, functional, and temporal aspects of environmental problems (Galaz *et al.* 2008). In biodiversity conservation, this means institutions must buffer against a diverse range of socioeconomic and biophysical drivers, commit to long-term strategies, and respond to short-term changes that can cause irreparable damage (Steinberg 2009). Spatial fit has received particular attention in biodiversity governance, with ecologists recommending a shift from overemphasis on species richness to multi-scaled approaches and especially landscapes (Likens and Lindenmayer 2012; Wu 2013). Such a shift will require institutional change. Importantly, that change will need to extend beyond the integration of the term in conservation initiatives and the high level, in principle agreement that a move toward adaptive, landscape-scale approaches will more effectively address key drivers of ecosystem decline (Wyborn 2011, 2015).

The aim of this article is to describe a conceptual framework for diagnosing and designing adaptive institutions for the conservation of biodiversity. When applied, the

framework assesses current institutional conditions and the extent to which these constrain or enable biodiversity conservation. The framework attends to adaptive capacity, or the ability of institutions to withstand and respond to change (Armitage and Plummer 2010); but equally highlights the importance of general capacity, or the ability to identify and solve problems and deploy knowledge and skills (Virji *et al.* 2012). Using the concept of adaptive governance as a foundation, it draws on literatures from institutional theory, especially institutional perspectives on organizational environments and public administration. The framework has been developed with landscape-scale approaches to biodiversity governance in mind, but is not wedded to a single scale or context. The fundamental objective is to identify and address the attributes of the institutional design problem, recognizing that institutions operate at multiple scales and governance levels.

This work addresses two critical issues for biodiversity governance. The first is a framework enhancing the largely theoretical descriptions of adaptive institutions by grounding them in the practical realities of organizations responsible for biodiversity conservation. This grounding is achieved by drawing on Pragmatist notions of evolutionary learning and collaborative, experimentalist governance (Dorf and Sabel 1998; Ansell and Gash 2008; Ansell 2011) and by incorporating thinking from institutional and organizational theory and public administration. The second is a framework explicitly enabling consideration of the unique aspects of biodiversity as a policy problem. This requirement is incorporated in the framework itself, which begins with a detailed analysis of the biodiversity problem in context, linking the institutional analysis to the ecological characteristics of the system of interest. After

outlining the rationale this new conceptual framework targeting biodiversity institutions, the rest of the paper outlines the framework itself and its application.

2. Rationale for the conceptual framework

The framework operationalizes the diagnostic approach (Young 2002; 2008), which is akin to a doctor diagnosing a patient by asking questions and prescribing treatment based on the answers to those questions. The method offers a way to cope with complexity by focusing inquiry on the salient characteristics of the biodiversity problem and how institutional practices are aligned (or maligned) with these characteristics. While Young (2008) provides examples of queries that could inform a diagnostic, these are merely a starting point and suited to his focus on joint problem solving in international environmental agreements. While other frameworks could be used for an institutional diagnostic for biodiversity conservation, this framework builds on Young's flexible approach, providing a tool that 1) incorporates considerations specific to conserving biodiversity and adaptive institutions, and 2) explicitly considers the constraints of organizations managing this public good.

A central idea of the diagnostic approach is that key problem characteristics should be integrated into an institutional analysis from the outset. This framework thus fills an important need for analysts considering biodiversity institutions. While general frameworks such as the Social-Ecological System (SES) Sustainability Framework (Ostrom and Cox 2010) can be used in institutional diagnosis, this framework is focused on extraction in common pool resource (CPR) situations (e.g. irrigation,

fisheries, and grazing commons) rather than the public goods delivered by ecosystems (McGinnis and Ostrom 2014). Its applicability to biodiversity conservation remains an open question (McGinnis and Ostrom 2014), as biodiversity differs fundamentally from CPR situations, where resources are generally non-exclusive and rival. As a public good, biodiversity is also non-exclusive; but it is non-rival (Perrings and Gadgil 2003), so identifying and allocating rights and responsibilities in biodiversity governance poses different challenges. While a number of the elements from the SES Sustainability Framework are relevant and appear in the diagnostic framework provided below, this is often with a different name or conceptualization (e.g. system understanding, information sharing, players, leadership and entrepreneurship, rules, self-organizing and networks).

The work by Young (2002, 2008) diagnosing international institutions, combined with Scott's (2014) blending of the regulative, normative, and cultural-cognitive dimensions of institutions, provided the starting point for the framework presented in this paper. The framework also builds on recent advancements in institutional analysis, where the focus has moved from the focus on stability in the CPR literature to a focus on enabling or identifying pathways to adaptation or transformation (Ferguson *et al.* 2013). Concepts known to enable the adaptive capacity of society (Gupta *et al.* 2010) and of social-ecological systems (Koontz *et al.* 2015), such as diversity and redundancy (see Section 3.5.2), have been incorporated into the framework. To help researchers better understand the practical limits of an adaptive approach in governing a public good such as biodiversity, it also draws on the

institutional literature, especially studies of institutionalized environments in organizational studies and public administration.

By comprehensively addressing the practical organizational and administrative issues that can impede an adaptive approach, this framework provides a much-needed tool for institutional reform. Practical limits on adaptive biodiversity governance relate to how authority and responsibility for biodiversity management are allocated. As a public good, governance of biodiversity relies in large part on public agencies and organizations receiving and administering public funds for its management, even as governance takes on a more networked form. Such organizations face a range of institutional impediments, hindering implementation of adaptive systems in practice, despite widespread enthusiasm and attention to adaptive governance in the literature (Rijke *et al.* 2012; Ojha *et al.* 2013). At the same time they are being asked to be more flexible, they are placed under ever-increasing administrative control due to low levels of public trust in bureaucracy (Ansell 2011).

Agencies and other organizations involved in biodiversity governance face significant challenges in moving to a more experimental approach, but they also should be viewed as a critical player in solving the biodiversity problem and building public consent for management actions. Pragmatism[1] explicitly considers this paradox, so ideas from Pragmatism were incorporated in the diagnostic framework. Pragmatism is a philosophy that engages concretely with questions of how public affairs should be

[1] 'Pragmatism' is used in this article to refer to ideas from philosophical Pragmatism, drawing on thinkers such as John Dewey, Charles Sabel, William Dorf, William James, and Charles Sanders Pierce (see e.g., Dewey 1927 Dorf and Sabel 1998). It is capitalized throughout to avoid confusion with the more general use of the term.

managed in a democracy (Dewey 1927; Ansell 2011). This framework draws mainly from Ansell's (2011) synthesis of how Pragmatist ideas can inform a more productive perspective of public organizations in fostering collaborative, reflexive governance.

Along with this Pragmatist view of institutions, other thinking from institutional theory, particularly with respect to organizational environments and public administration, is used in this paper to moderate the ambitious ideals elaborated in the adaptive governance literature. These refinements encourage consideration of both the constraints (e.g. narrow legislative framing) and the opportunities (e.g. formal authority to act) that influence the behavior and capacity of responsible agencies.

3. Conceptual framework

Although grounded in Young's (2002, 2008) diagnostic, this framework has a targeted focus on institutional conditions supporting biodiversity conservation at multiple scales. The framework draws on Young's '4 Ps' of problem, players, politics, practices, but modifies them substantially to elaborate the categories and give greater attention to 'practice', here conceptualized and operationalized as competence and capacity (two of the four components in Figure 1). The content of each component has been specifically designed to incorporate concepts from adaptive governance and link these to insights from Pragmatism and institutional theory, especially with respect to organizational environments and public administration.

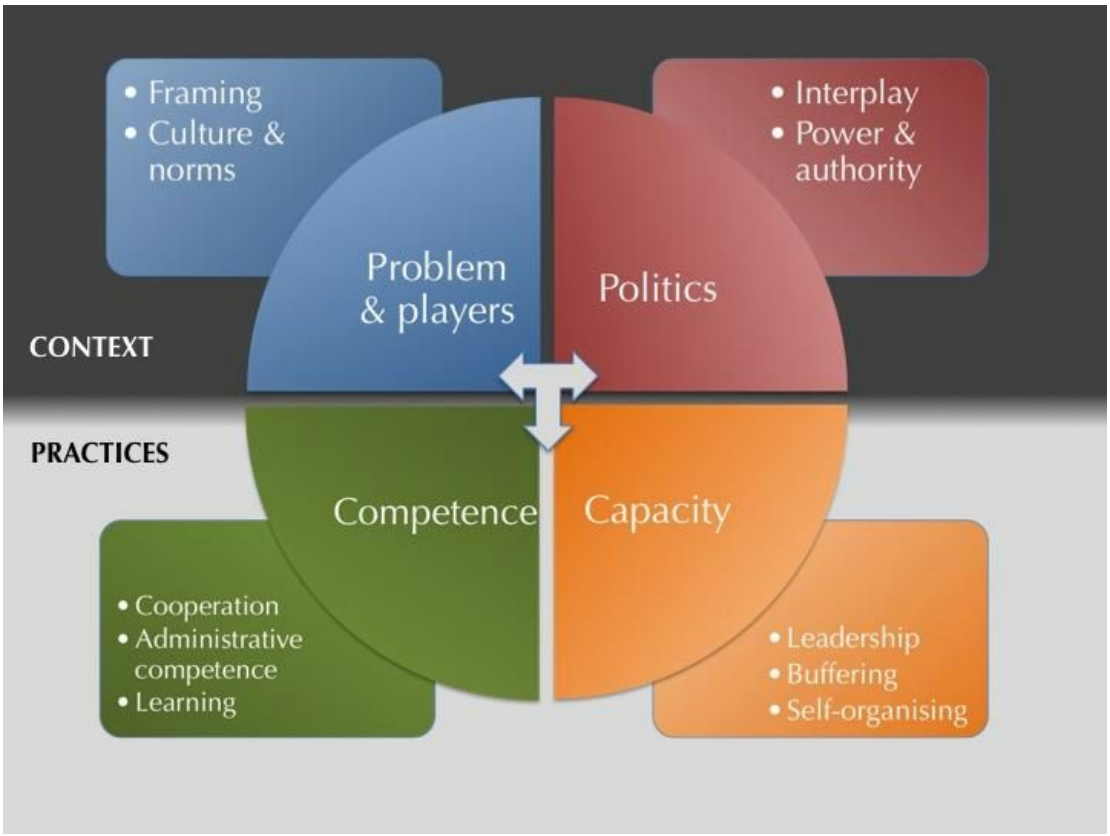

Figure 1 Categories and components of the framework

Four academics with expertise in biodiversity governance acted as key informants (Neuman 2013), reviewing a draft of the framework. They were asked to comment on each component, as well as offer comments on the theoretical underpinnings and structure and completeness of the framework. Following this expert peer review, the framework was simplified by combining several components, and the descriptions were edited to clarify key concepts. The final version is presented in the next section.

3.1 Foundation of the framework

The conceptual framework is organized as four broad categories: problem and players, politics, and two practice categories: competence and capacity (Figure 1 and Table 1). Every component of this framework is built on the notion of fit; the analyst must consider how current institutions fit (or do not fit) with the ecological

characteristics of the problem being managed. The first two categories enable the analyst to understand the general features of the governance context influencing biodiversity-relevant institutions and ask the analyst to consider the specific characteristics of the biodiversity problem in the case of interest. These aspects interact strongly (e.g. politics has a strong influence in how the problem is framed and which solutions are preferred). Together these influence the practice categories (Figure 1), which focus more acutely on issues related to adaptive capacity in biodiversity governance (Table 1). Each broad category is further articulated, with the framework comprising 10 components.

Table 1. Overview of components in conceptual framework

Component and Summary	Aspects	Selected References
Problem and players		
Framing: Problem-framing sets the agenda and players and drives subsequent actions. Organizations provide the framework through which information is interpreted.	● Definition of biodiversity and scale problems ● Diagnosis of problem causes ● Evaluation of causal agents and their effects ● Proposed solution	Apostolopoulou and Paloniemi (2012); Entman (1993); Goffman (1974); Manning (2008)
Culture and norms: These drive group and organizational behavior through shared perceptions of what is proper and improper behavior in a particular situation.	● Impact of culture and norms on behavior ● Cognitive fit	Cleaver (2012); Schneider *et al.* 2013; Scott (2014)
Politics		
Interplay: A range of interacting institutional arrangements influences biodiversity conservation across scales and levels**.**	● Functional interplay ● Political interplay ● Regime interplay	Paavola *et al.* (2009); Vatn and Vedeld (2012); Young (2002)
Power and authority: Adaptive governance calls for greater power sharing, and devolving authority to appropriate levels. Institutions codify power relations and can block change, but also empower actors and enable collective action.	● Dynamics of power and influence ● Authority ● Roles and responsibilities	Clegg *et al.* (2006); Ring (2008); Lukes (1974)

Practices – competence		
Cooperation: Biodiversity attributes and threats occur across tenures and jurisdictions, requiring cooperation between actors and across scales and governance levels.	• Level of cooperation • Conditions supporting or hindering cooperation	Ansell and Gash (2008); Pollock *et al.* (2008); Wondolleck and Yaffee 2000
Administrative competence: The translation of biodiversity conservation from paper to practice requires knowledge and capability. A shift to larger scale approaches requires commensurate resources and competencies.	• Human resources • Financial resources • Institutional and organizational practices	Christensen and Gazley (2008); Ostrom (2005); Primmer and Wolf (2009)
Learning: A deliberate process of adjusting goals and approaches in response to experience and information. It can enable change but also sustain practices.	• Feedback • Self-reflection • Systems understanding	Ansell (2011); Argote and Miron-Spektor (2011); Boyd and Folke (2011)
Practices – capacity		
Leadership and Entrepreneurship: Leadership can be structural, entrepreneurial and intellectual. It can come from any level of governance and provide important functions, including supporting innovation, providing vision, influencing culture, and supporting learning.	• Leadership types and influence institutional practices • Constraints on leadership capacity	Black *et al.* (2011); DiMaggio (1988); Young (1991)
Buffering: Institutions must be able to recognize thresholds and disturbances and respond adequately to buffer ecosystems. Organizations need to buffer against changes in the external environment to achieve objectives over the long term.	• Redundancy • Response diversity • Organizational buffering	Boyd and Folke (2011); Elmqvist *et al.* (2003) O'Toole and Meier (2011)
Self-organizing: Self-organizing networks can build institutional memory, fill gaps in formal responsibilities, and provide backup capacity.	• Subsidiarity • Networks • Institutional support for self-organizing	Ansell (2011); Folke *et al.* (2005); Morgan (2006); Pelling (2011)

Insights from institutional literature on organizations and public administration were particularly influential in the development of the practices components. Concepts with practical utility from institutional studies of organizations, such as organizational buffering, have been incorporated into the framework to ground the diagnostic in

current knowledge about organizations. The insights from public administration ensure fundamental conditions, such as administrative competence, are considered in the diagnostic. Drawing from scholarship in institutional theory, the framework pays particular attention to learning, leadership, and institutional entrepreneurship as pathways to change.

Pragmatism provides insights into how public agencies can play a more productive role in solving the biodiversity problem. It calls for collaborative problem solving that bridges the public-private divide, and focuses on how this problem solving and administrative competencies can provide scaffolding for larger-scale institutional change (Ansell 2011). Pragmatist ideas that inform the framework include evolutionary learning, a model that builds on habit and organizational routines, and insights on enabling more autonomy and discretion in the public service. Brunner *et al.* (2005) note that the notion of learning from experience on the ground, embedded in adaptive governance, is already an expression of Pragmatism. Several other authors have explored how this philosophy might revise the philosophy of adaptive management in sustainability (Norton 2005) and biodiversity (Dedeurwaerdere 2010; Maris and Béchet 2010). This framework takes this a step further by integrating these concepts into a usable tool for diagnosing and designing biodiversity institutions.

The framework is applied by translating the aspects of each component into diagnostic queries to guide data collection, with initial answers guiding deeper inquiry. The intention of the framework is not to prescribe an ideal governance form, but to enable an understanding of the current system and build a strategy to foster

more adaptive institutions on this foundation (Clement *et al.* 2015b). As with other conceptual frameworks, the analyst should choose the unit of analysis at the outset, with the framework flexible enough to apply to a particular organizational unit or to a sub-national or national biodiversity governance system. A landscape-scale assessment would best align the diagnostic with SES approaches. In such an analysis, organizational theory can inform an exploration of how organizations interact and network, how their culture affects their behavior in the governance system, and how problem-framing and problem-solving varies across the governance system. Further guidance for applying the framework is provided in the final section.

3.2 Problem and players components

3.2.1 Framing

Framing considers how biodiversity is conceptualized, who and what contribute to its decline or conservation, and what solutions are prescribed. It is assessed using four aspects: problem definition, diagnosis of causes, evaluating causal agents and their effects, and suggested remedies (Entman 1993). The final aspect should include consideration of the actors with a role in solving the problem. Frames organize an actor's understanding and perception of reality (Goffman 1974), setting the agenda and translating facts, values, and interests into policy (Fünfgeld and McEvoy 2014). Consistent with Pragmatism, framing forces inquiry and reflection on the problem itself, incorporating both a 'working theory' of the biodiversity problem itself and its context-specific characteristics (Ansell 2011).

Analyzing the specific characteristics of the problem, and the players involved in solving and/or causing the problem is useful for several reasons. First, it focuses the diagnostic on the salient aspects of the biodiversity problem and how institutions do or do not address these aspects. For example, is this a private landscape, where landholder decisions are a driving force of biodiversity conservation and decline? What are the most significant drivers of decline, and can governance influence them? This can help identify if there are gaps in current approaches. Second, it helps capture the diversity of frames, and how that influences other factors, such as collaboration and learning. Third, understanding players, especially in reference to the specific problem characteristics, can help identify opportunities and constraints. For example, resource user groups (e.g. landholders, tourists) may be contributing to biodiversity decline, but institutions may be focusing only on their role as causal agents, and not in solving the problem. Framing is thus fundamental to a diagnostic because it influences all other components.

Little research exists on framing in biodiversity governance, but it can provide valuable information on the drivers behind policy debates and the extent to which scientific concepts are (or are not) integrated into practice (Apostolopoulou and Paloniemi 2012). Often a shared problem definition is tacitly assumed, but unstated assumptions and diverse frames frequently contribute to governance failure (Freitag 2014). Biodiversity is a complex, nebulous conservation target that is often poorly defined, despite widespread adoption (Redford *et al.* 2003). Despite broad definitional agreement, many aspects of the problem remain poorly understood (Hooper *et al.* 2005), and the concept is inconsistently applied and often conflated with other

ecological concepts, limiting policy efficacy (Mace *et al.* 2012). Views on spatial and temporal scale are also diverse and are of interest in both the ecological (e.g. (Lindenmayer and Hobbs 2008; Wu 2013) and governance (e.g. (Termeer *et al.* 2010; Lawhon and Patel 2013) literatures. How scale is framed in biodiversity governance thus merits focused attention.

In a diagnostic, frames can be considered in multiple arenas. Organizations are a larger structure for considering framing and mutually ordering ideas to achieve a 'working consensus' (Manning 2008). Frames often originate in the political arena and seek to influence how actors should think about issues. Importantly, the way ideas are framed determines the manner in which an issue is resolved, but these political definitions may be antithetical to actually solving the problem (Peters 2012). Political ideologies like neoliberalism may not be explicitly stated but have a major influence on the way biodiversity conservation is approached (Turnhout *et al.* 2013). Examining frames and the fundamental styles of thought forming the social and institutional fabric can help make sense of governance and point to areas where institutions have poor cognitive fit (Cleaver 2012). Choosing reforms that purposely align with or challenge such aspects is an important consideration in design efforts following a diagnostic.

3.2.2 Culture and norms

Institutions guide behavior through cognition and culture (Scott 2014). This component encompasses the latter and contributes to analysis of cognitive fit (Cleaver 2012), along with framing. Many of the key actors with responsibility for solving the

biodiversity problem work in organizations, where culture and norms are embedded. Organizational culture consists of shared beliefs and values, which guide behavior of individuals within the organization and generate expectations on how they should act (Schneider *et al.* 2013). Culture and norms are important for 'new governance', which relies heavily on social norms for compliance (Pollock *et al.* 2008). Norms are practices relying on shared group perceptions of what is proper and improper behavior (Ostrom 2005).

Cultural dimensions of institutions are among the most difficult to fully access, but play a foundational role in how information about biodiversity conservation is processed. Culture is like a filter, telling players which information is important and how it is processed and acted upon (Scott 2014). It establishes informal/formal rules and norms, drives decisions of resource use, and guides interaction between members of a group and with outsiders (Schneider *et al.* 2013). Relating this to other components, culture can work for or against cooperation (Wondolleck and Yaffee 2000), both within and across organizational boundaries. Adopting a problem-driven perspective is a crucial condition to support learning (Ansell 2011) and can be embedded in the culture of organizations and networks. In reference to biodiversity, cultural and normative influences on perceptions of biodiversity (e.g. people-oriented conservation or 'hands-off' protection) and motivations for its use and conservation can have a profound effect on the goals and strategies used (Wilshusen *et al.* 2002).

3.3 Politics components

3.3.1 Interplay

Interplay refers to the dynamics of cross-level and cross-scale interactions between institutions, for example where one set of institutional arrangements affects those elsewhere (Young 2002; Oberthür and Stokke 2011). It is a key analytic theme in institutional analysis, and often grouped with fit and scale under the umbrella of 'the problem of fit' (Galaz *et al.* 2008). It draws attention to the interaction of multiple institutional arrangements across scales and governance levels (Paavola *et al.* 2009). Generally interplay is conceptually grouped into vertical (across levels of governance) and horizontal (within the same level of governance) (Young 2002), but these neglect causal factors (Oberthür and Stokke 2011) and are conceptually ambiguous and easy to conflate (Vatn and Vedeld 2012).

This framework instead uses three aspects to interrogate interplay in a diagnostic – functional, political, and regime – and incorporates governance levels in those categories. Functional interplay is critical for considering the ecological dimensions. It has also been called 'impact-level interaction' (Oberthür and Stokke 2011) and occurs because SESs are linked and interdependent, thus solving one problem can affect another (Young 2002). For example, eradicating fox populations may cause a spike in rabbit populations. Such interactions are unintentional, but should factor into decision-making. Political interplay often occurs because of intentional design and the politics of management (Young 2002). Political interplay can also occur because of competing or conflicting goals (e.g. economic development versus habitat protection)

and can signal discordant approaches impeding biodiversity conservation across governance levels.

Regime interplay occurs between a framework to conserve biodiversity and other frameworks (e.g. property rights, economic structures, agriculture). This captures the interactions with institutions directed toward other problems, which can significantly impact success of biodiversity conservation, particularly pre-existing institutions like property rights (Paavola *et al.* 2009; Vatn and Vedeld 2012). Such interdependencies are often beyond the realm of influence when reforming governance, but considering their influence in a diagnostic can direct attention to ways their influence can be moderated, used productively, or to develop more realistic reform options.

3.3.2 Power and authority

Based on the notion that power relations can build or undermine SES resilience, adaptive governance calls for more collaborative arrangements where power is shared (Huitema *et al.* 2009). Power is exercised when actors pursue values, interests and goals (Gordon 2009) and can act as both catalyst and impediment to institutional change (Greenwood and Hinings 1996). Authority refers to the formal or official roles of actors, and power is embedded in hierarchies of authority (Lukes 1974; Hutchcroft 2001). Many conceptions of power could be used within this framework. One useful typology considers covert or overt power; latent power; and influence (Lukes 1974).

Adaptive governance supports the ideal of power-sharing, but power is often treated superficially, as it is in mainstream institutionalism (Moe 2005; Wittneben *et al.*

2012) and resilience thinking (Berman *et al.* 2012). Power and authority have been given their own category in this framework to raise the profile of its importance in diagnosis. A key challenge is the concentration of power at the top end of governance regimes and within organizations, which are among the most hierarchical entities of modern times (Clegg *et al.* 2006). Shared power can also lead to suboptimal outcomes and inefficiencies. To find a third way between fully shared and hierarchical models, Pragmatism suggests the separation of powers and mediation by third parties (e.g. informal networks, the public, NGOs) (Ansell 2011). Diagnoses should seek to describe and understand current power dynamics to identify areas where the redistribution of power would be feasible and beneficial.

The nature and location of formal authority are key considerations. Legislative mandate is particularly important in landscape-scale biodiversity conservation. While no guarantee of permanence, legislative mandate increases the likelihood that arrangements will survive beyond governments. It also serves as a reminder, however, that transcending spatial scales is difficult for government agencies, whose authority is tied to legislative and jurisdictional boundaries.

A diagnostic should consider the definition, clarity, and acceptance of roles and responsibilities. These aspects support successful collaboration and good governance, particularly accountability (Lockwood 2010). Adaptive governance often prescribes devolution of authority to local levels (Folke *et al.* 2005). Shifting roles and responsibilities from central authorities to more regional entities is often suggested for landscape-scale biodiversity conservation, with mixed results (Clark *et al.* 2015).

Retaining some measure of central authority and policy setting is likely a better fit for a public good like biodiversity, however, due to high levels of spatial externalities (Ring 2008).

3.4 Practices (competence) components

3.4.1 Cooperation

Effective biodiversity conservation requires cooperation, especially at landscape scale, as biodiversity attributes and processes are located across tenures and jurisdictions. Cooperation refers to a range of activities, from simple networking to collaboration. There is no hard and fast rule about what level is required in conservation, with it really being a matter of 'horses for courses' (Ross *et al.* 2002). While some activities, like mapping of threatened species, may require individuals and organizations to merely network and share information; others, like running joint incentive programs or weed eradication, require much more time, trust, and sharing of resources.

Literatures on adaptive governance, connectivity and landscape-scale conservation emphasize the importance of collaborations with wide range of stakeholders (Pollock *et al.* 2008; Wyborn and Bixler 2013). Though public agencies retain ultimate authority to make decisions, stakeholders must be directly engaged in decision-making, and not merely consulted, if collaborative governance is to move beyond adversarial and top-down, closed decision-making (Ansell and Gash 2008). Such levels of collaboration can be difficult to achieve, but provide long-term benefits

by building public support for agency missions. Realistically, even less ambitious cooperative activities still have merit as a way to build collaborative capacity and trust (Imperial 2005; Ansell 2011). A diagnostic identifying a lack of trust or public support can be indicative of failed collaboration.

Diagnosis should attend to institutional conditions that enable and constrain cooperation. Shared vision, opportunity and incentives to work together, trust, supportive organizational norms, flexible policies and procedures and appropriate human and financial resources are factors that can enable collaboration across scales and governance levels (Wondolleck and Yaffee 2000; Fitzsimons *et al.* 2013). A rich institutional environment in which organizations have overlapping roles and scales can also support collaboration (McGinnis 2011b), though too much overlap can trigger competitive behaviors that undermine collaboration in biodiversity conservation (Wyborn and Bixler 2013).

3.4.2 Administrative competence

A shift to larger scale conservation approaches requires commensurate resources and relevant rules and strategies. All the components in the two practices categories of this framework (both capacity and competence) contribute to competence in the Pragmatist view, but this component specifically deals with the basic resources and conditions necessary to competently and effectively carry out management (Christensen and Gazley 2008). In this framework it is comprised of human resources, financial resources, and institutional and organizational practices. Here the public administration and organizational studies literatures make important contributions.

Conservation of biodiversity requires both internal competencies, which include human capital and organizational routines, and external competencies that link to the resources of external actors (e.g. expertise and knowledge) (Primmer and Wolf 2009). Human and financial resources are dominant dimensions of administrative competence. Human resources, or the skills, knowledge, quantity and quality of employees, are especially emphasized as dimensions of public and non-profit organizational capacity (Christensen and Gazley 2008). Neither financial nor human resources are held by actors in isolation, and in networked governance arrangements the linkages between organizations and to the external environment affect capacity and the relative influence of different actors in biodiversity governance (Primmer and Wolf 2009).

A focus on institutional and organizational practices gives explicit attention to the rules and strategies used in current institutional arrangements, both on paper and in practice. The latter are particularly important for enabling multiple actors to work together and generating tacit understanding and expectation (Ostrom 2005; Pollock *et al.* 2008; Young 2002). Adaptive governance and Pragmatism both call attention to the importance of deliberation and conflict resolution practices, which can enable learning and change (Dietz *et al.* 2003; Norton 2005; Ansell 2011). Attention to scale is critical when diagnosing biodiversity institutions. Tiering provides one means of diagnosing this competency, by examining whether key principles, concepts or objectives from larger scales are carried down to smaller scale efforts (Annandale *et al.* 2001).

3.4.3 Learning

Learning includes feedback, self-reflection, and system understanding. Feedback and reflexivity are thought to enable resilience (Boyd and Folke 2011). Reflexivity is a necessary precondition for evolutionary learning in Pragmatism, and involves critical scrutiny of habits and commonsense, such as the usefulness of existing approaches and the nature of the problem (Ansell 2011). Feedback calls attention to the need to gather information, referring to the practice of monitoring and channels to transmit diverse forms of knowledge (Boyd and Folke 2011). System understanding is regarded as a foundation for learning, and is also hypothesized as enhancing management planning and effective implementation, capacity for collaboration, and shared decision-making (Cundill *et al.* 2012). It complements the notion of analytical holism in the Pragmatist literature, where successful problem-solving requires breaking complex problems into concrete parts and attacking them in a highly focused way, while also considering the broader context in which problems occur (Ansell 2011).

Adaptive governance is closely linked to adaptive management; thus learning is at the heart of an adaptive governance approach. Models of double-loop learning are often used, where actors question underlying assumptions; reframe the problem, goals and interests; and may even apply different values (Pahl-Wostl *et al.* 2010). Organizations that embody this form of learning have proven elusive in practice (Caldwell 2012), and learning in organizations is quite different, particularly under conditions of uncertainty and rapid change (Sproull 2010).

Pragmatism offers an alternative and potentially more useful perspective on learning. It re-focuses on trial-and-error learning, which creates progressive learning and associated changes to both organizational routines and values (Rerup and Feldman 2011). It acknowledges the cumulative nature of learning and how concrete experiences give context to broader knowledge about biodiversity. For example, the scientific knowledge and legal basis for cross-border collaboration for conservation existed for several years before it was implemented by US government agencies in response to heated encounters with environmental groups (Thomas 2003). Though reflexivity is a necessary condition for evolutionary learning, habits and routines are also important because they conserve knowledge and expertise (Ansell 2011). Organizational theory provides similar insights into learning, highlighting how the organizational context, external environment, and pre-existing institutions influence learning (Argote and Miron-Spektor 2011). A diagnostic can help evaluate existing routines and contextual influences and to identify feasible pathways to enhance reflexivity, feedback, and understanding.

3.5 Practices (capacity) components

3.5.1 Leadership and entrepreneurship

Assessing leadership capacity involves identifying the types of leaders present, their influence on practices, and constraints on deployment of leadership capacity to identify areas where capacity is weak and/or underutilized (Table 1). Leaders include senior politicians, governors and managers, as well as individuals outside normal executive roles who perform leadership functions, such as providing and institutionalizing a vision and culture change within an organization (Beach 2006;

Schneider *et al.* 2013). Leaders can support collaboration, learning, innovation and change. Leadership can come in many forms, including structural, intellectual, charismatic, and entrepreneurial (Young 1991). Institutional entrepreneurs are the actors who actively work to transform existing institutions or create new ones (DiMaggio 1988; Battilana *et al.* 2009). They are thus critical to pursuing institutional change and are here considered as part of leadership.

Leadership for biodiversity conservation requires, among other things, "an ability to share a clear, long-term vision; orientation toward 'hands-on' management; an ability to switch thinking between the big picture and the detail; and a willingness to encourage learning, improvement, and receptiveness to alternative solutions" (Black *et al.* 2011, p. 329). Adaptive governance aspires to leaders that can guide transitions, foster network formation, are attuned to feedback, have the capacity for deep reflection and learning, and are willing to experiment and adapt strategies where required (Olsson *et al.* 2006).

Biodiversity conservation governance requires cooperation among many individuals with diverse interests, suggesting a need for collective institutional entrepreneurship, which has received comparatively little attention (Wijen and Ansari 2007). This form of entrepreneurship requires collaborative leadership and institutional work including advocacy, defining, vesting, constructing identities, changing normative associations, constructing normative networks, mimicry, theorizing, and educating (Lawrence *et al.* 2009). These requirements range from overtly political (advocacy) to subtly introducing change by aligning it with existing practice (mimicry), and can provide an

analytical lenses to study entrepreneurial activity, which can signaling promising pathways to institutional change.

3.5.2 Buffering

Buffering enables SESs to cope with uncertainty and surprises and provides backup if one part of the system fails. It has three forms: functional diversity or redundancy, response diversity, and organizational buffering. Redundancy rests on multiple institutions performing the same function (Chapin III *et al.* 2009). Response diversity is underpinned by the notion that heterogeneity can provide strength, calling for institutions to have several different responses to disturbances (Elmqvist *et al.* 2003) and tools that cover both shorter- and longer-term timescales (Fitzsimons *et al.* 2013). Organizational buffering refers to the strategies used to protect, insulate or mitigate impacts on performance from the external environment (O'Toole and Meier 2011).

Translation of the concept of buffering from ecological to institutional resilience is relatively new, but builds on the premise that institutions should functionally fit ecosystems. This means recognizing thresholds and disturbances and responding adequately to buffer ecosystems (Galaz *et al.* 2008), and also thinking systematically about reforms well before institutions fail (Young 2010). Institutional features related to buffering include leadership capacity; objective setting, planning, and backup; and having vision and strategies for unknowns (Boyd and Folke 2011). Buffering calls for biodiversity institutions to incorporate a portfolio of strategies to deal not only with immediate threats (e.g. feral animals) but also to prepare for and mitigate future impacts (e.g. agricultural intensification as commodity markets change).

Buffering strategies are an essential element of capacity to enable organizations to carry out policy objectives as they interact with turbulent external environments (e.g. budget cuts, political pressures) (O'Toole and Meier 2011). While openness to external environments can help organizations build public consent, it also leaves them vulnerable to influence (Ansell 2011). Changes to procedures or structures can act as buffers, such as units to handle uncertainty and external instability, or creative strategies to protect core programs despite diminishing resources (Meier and O'Toole 2008; O'Toole and Meier 2011).

Buffering strategies can be internal or external and include defending, prospecting, or reacting (Meznar and Nigh 1995). More proactive (rather than reactive) strategies would better buffer volatile political contexts and better fit the dynamics of ecosystems, where anticipation is an important aspect of management. External networking activities such as boundary-spanning and bridging can help prepare for unknowns and manage potential crises (Termeer and van den Brink 2012) and support SES resilience (Hisschemöller and Sioziou 2013; Sternlieb *et al.* 2013). Shadow networks sitting on the boundaries between formal and informal networks, also contribute to buffering and provide a source of novel ideas and approaches. Their positions at the boundaries of formal networks allows for flexibility and change as well as continuity with earlier innovations (Olsson *et al.* 2006; Pelling 2011).

3.5.3 Self-organizing

Self-organizing considers: empowerment of actors to act locally (e.g. subsidiarity); networks providing informal spaces for sharing and making decisions based on knowledge, experience, and chance; and institutional support for such networks.

Common accountability mechanisms seek to ensure responsibilities are fulfilled by exerting control over agencies through rules, incentives and sanctions. These controlling mechanisms not only constrain autonomy and discretion; but also diminish performance, thereby creating more mistrust and a call for greater controls, creating a vicious cycle (Ansell 2011).

Pragmatism asks for agencies to be granted greater autonomy, in exchange for demonstrating capacity and willingness to take ownership of problems. This requires developing a strong sense of responsibility for outcomes in an organization, and organizations must be active participants in setting these standards (Ansell 2011). In a diagnostic, a first step is to examine where hierarchical control constrains (or enables) self-organizing activities and capacities. Seeking to understand the reasons for that control (e.g. past failures) can help in forging new strategies to increase managerial discretion based on the concept of accountable autonomy (Fung 2004).

For biodiversity, since the beneficiaries of the good are much more widely dispersed than the users, harmonization is required at higher governance levels, especially in setting standards and policies (Ring 2008). However, this must be balanced against the principle of subsidiarity and the conditions 'on the ground', requiring a multi-level understanding of the governance context (Paavola *et al.* 2009). Subsidiarity thus serves as an organizing concept, highlighting which responsibilities should be devolved to the lowest levels and which are best left to regional, state, and national authorities. These broader responsibilities emphasize again the importance of authority, and having the authority to act at the right scales.

Adaptive governance highlights the role of networks in fostering resilience by preparing the governance system for unknown unknowns (Boyd 2011). Networks also provide social capital and can build trust, both of which support collective action and provide assets in times of stress (Berman *et al.* 2012). As informal spaces for actors to share and make decisions based on knowledge, experience, and chance, networks also provide adaptive capacity by building social memory, which can be revitalized in times of system stress (Boyd 2011). Institutional theory in organization studies stresses the more fundamental importance of such networks in providing stability, legitimacy, and resources, with relationships across organizational boundaries often even more influential on effectiveness than the institutional context alone (Powell and DiMaggio 1991; Morgan 2006).

4. Application of the framework

4.1 Conducting an institutional diagnosis

This section provides a brief overview of how this framework can be used to as a diagnostic and design tool, through its application to biodiversity conservation institutions in the Tasmanian Midlands of Australia. In this highly modified agricultural landscape, biodiversity attributes are highly fragmented and exist almost entirely on private property. Conservation approaches in the Midlands thus focus on incentivizing involvement of private landholders, with federal and state biodiversity policies focusing investment on particular rare species and ecological communities. Federally listed lowland native grasslands are of particular interest to government and

non-government organizations, but this critically endangered ecological community is expected to come under even greater threat from large-scale irrigation investment.

The basic premise behind a diagnostic is to ask a series of questions, and the answers to those questions will guide deeper inquiry. Here, each aspect of the framework is translated into diagnostic questions (refer to supplementary material). Asking these questions is the third step in a five step process (Table 2). The methods accompanying each step are given in the following section. They were largely qualitative, and included document analysis, a novel linguistic tool (Clement *et al.* 2015c) in-depth interviews, and focus groups (Clement *et al.* 2015b).

Table 2. Steps for applying the conceptual framework

	Description
Step 1	Develop research questions, which will guide data collection and narrow the focus of the analysis. The diagnosis may focus on the whole suite of institutional arrangements or only one part (e.g. a policy or program).
Step 2	Translate each aspect of the framework into a question (refer to supplementary material) and select methods to answer these questions. As with all case study research, developing a case study protocol and case study description at this stage is good practice (Yin 2009).
Step 3	Collect data for each question, which generally requires a combination of methodologies. Beginning with document or content analysis is often useful, as it can be used to provide a description of both a) characteristics of the ecosystem being managed and b) the relevant institutional arrangements and identify key actors, policies, and programs. Both of these inform the framing component. In practice, institutions often deviate from documents, however, so methods such as participant observation, interviews, network analysis and surveys can importantly and essentially provide access to these institutions-in-practice (Ostrom 2005).
Step 4	Analyzing the resultant data to reveal areas of good and poor performance, especially institutional misfits and constraints on achieving biodiversity objectives. Questions requiring further investigation will often emerge at this stage, at which point it may be necessary to collect more data (Step 3). It is also during this step that the relationships between components can be clarified in more detail (Section 5).
Step 5	Identify potential governance reforms that can build adaptive capacity and address areas of poor performance, building on current strengths (Clement *et al.* 2015b). Best practice case studies from elsewhere can inform this process, as can workshops and focus groups. Findings from earlier steps can also be presented at this stage, in a process of triangulation.

4.2 An example: Diagnosing the Midlands' biodiversity institutions

Step 1

The analysis started with a central query: how do institutions enable (and constrain) biodiversity conservation? A social-ecological systems analysis (Mitchell *et al.* 2015) assisted in understanding of key social, ecological and governance drivers influencing biodiversity and hence the nature of the institutions required to conserve biodiversity in the Midlands.

Step 2

Table 2 illustrates how the framework (Fig. 1, Table 1) was translated into diagnostic questions. This translation will vary from application to application.

Step 3

The document analysis informed a summary of biodiversity conservation institutions and the social-ecological characteristics of the area informed an understanding of the context (Clement 2012). This analysis of the institutional and social-ecological context provided an overview of the issues in the Midlands, which include the location of almost all biodiversity values on private property, the loss of key ecosystem processes, and increasing agricultural intensification in this highly modified agricultural ecosystem. A novel linguistic tool for analyzing institutions, the Institutional Grammar Tool (Crawford and Ostrom 2005), was also used on a selection of documents and the results collated to identify themes in these documents (Clement *et al.* 2015c).

Conducting in-depth interviews informed by the diagnostic questions with 49 respondents after this analysis enabled the authors to probe more deeply on key issues that emerged (refer to supplementary material). In particular, the 'on paper' analysis revealed problems with framing (Section 3.2.1), where the dominant focus on protecting rare species provided poor institutional fit for this highly modified landscape. The interview transcripts were analyzed using a combination of deduction and induction, using a priori codes from the framework (Creswell 2013), followed by a second level of analysis where emergent themes were identified from coding patterns in the data (Miles and Huberman 1994). This process confirmed the findings of the document review and provided further clarification of institutional issues in need of reform.

Step 4

Ultimately, problems with 'narrow' framing were found to have a flow-on effect throughout biodiversity institutions. Weak authority, interplay with powerful economic development and irrigation institutions, and the failure to institutionalize self-organizing efforts were found to be particularly salient issues in the diagnosis of Midlands biodiversity institutions (Clement *et al.* 2015a, 2015b, 2015d). Unclear roles and responsibilities, as well as whether power and authority were sufficiently strong (Section 3.3.2) to buffer key ecological and political drivers (Section 3.5.2), were additional issues explored further in interviews to understand if these problems 'on paper' were constraining effective conservation practice (refer to diagram in supplementary material).

Step 5

The results from the interviews, application of the Institutional Grammar Tool and document analysis helped identify areas of both strength and weakness, important for both diagnosis and designing institutional reforms (Clement *et al.* 2015b). Step 5 calls for reform (Table 2). Using case studies, theory from the literature and knowledge of the practical constraints of the institutional context, two sets of reforms were generated (Clement *et al.* 2015a; Clement *et al.* 2015b). Both reforms emphasized self-organizing and were differentiated by the level of formality in structure, the process for planning and prioritizing across the landscape, the players involved, and the roles and responsibilities of these players. These reforms used the concept of scaffolding from Pragmatism (Ansell 2011) to build on current strengths. Initially these reforms were tested in focus groups, providing an opportunity to discuss the results of the diagnostic and whether the proposed reforms would address key issues and were realistic. The reforms were then tested in a workshop to assess whether they were likely to affect biodiversity outcomes (Mitchell *et al.* 2015).

5. Conclusion

This framework provides the basis for diagnosing and designing institutions for the conservation of biodiversity. It draws on the strength of the institutional diagnostic approach (Young 2002, 2008) by directing attention to the significant elements of the biodiversity problem. The framework also calls on Pragmatism to consider how current competence and capacity can be better deployed and built upon through

concrete local problem solving, building towards the large-scale changes needed to achieve biodiversity outcomes.

The framework supports the largely theoretical principles of adaptive governance with the practical realities of institutional environments, as viewed from a Pragmatist perspective. A Pragmatic approach to reforms builds on lower order skills and competencies through concrete problem solving and small-scale experiments. These provide scaffolding to support more comprehensive change (Ansell 2011). Building on current competencies and capacities can ultimately support large-scale institutional changes, such as re-framing the biodiversity problem. Although the end result of such design efforts is unlikely to conform to the adaptive governance ideal, it recognizes the limitations of rational design and builds on the strengths of existing institutions. Such a rationale, of building a future through incremental positive steps, is the Pragmatist path to institutional change

Additionally, the broad scope of literature underpinning this framework allows consideration and inclusion of adaptive governance components, and just as importantly of difficult-to-conceptualize issues such as buffering, self-organization, leadership and learning. These issues are central to both adaptive governance and institutional and administrative theory, but to-date have provided particularly difficult to operationalize and consider in a practical way in the adaptive governance domain. Insights on institutions, organizations, and public administration, facilitate analysis using this framework by demanding diagnosis of 'what is' and only then progressing to what might be.

Diagnosis using this framework is a relatively straightforward process, with rapid appraisals through to in-depth investigations possible. This article briefly overviewed the diagnostic method using this framework, as applied in one Australian case study, however, the extent and depth of investigation will vary depending on the research questions, the time and resources available, and whether a researcher or practitioner carries out the diagnostic. Future research could further develop each component and the relationships between them, informed by empirical research. The problem and players components (framing and culture and norms) influence all other components, as they form the 'working model' of biodiversity conservation in any particular context. The relationships between variables within the components (e.g. how self-organizing affects learning, or how leadership can affect the range of solutions) are specified broadly, however, relationships between components and the variables they encompass are best observed and tested through empirical studies.

Several other aspects of the framework could benefit from further research attention, building on the insights from the Pragmatist, organizational and institutional theorizing provided in this paper. Learning remains difficult to research especially within large organizations with risk-adverse cultures. Pragmatism provides insights, but the conditions to support learning over time are not fully understood. Institutional 'experiments', beginning with an understanding of existing learning routines and organizational constraints, seem a promising approach. Collaborative research to investigate feasible pathways for enhancing reflexivity, feedback and understanding can then build on this important foundation. All three are essential for adaptive

governance. An essential element of this collaboration would be reconciling the aspirations of those more theoretically grounded in adaptive governance with the practicalities of the organizational environments within which biodiversity conservation occurs.

Two other difficult to research but important areas are self-organizing and buffering. This paper has progressed the task by providing insights from organizational and institutional theorizing. Here, as with learning, a collaborative experimental approach suggests a way forward, where strategies facilitating self-organizing and buffering could be tested. The success of these experimental approaches rests on longstanding and trusting relationships between researchers and participants, suggesting that successful adaptive governance (where research is regarded as essential for progress and success) must rest on transdisciplinary research efforts spanning academia and management.

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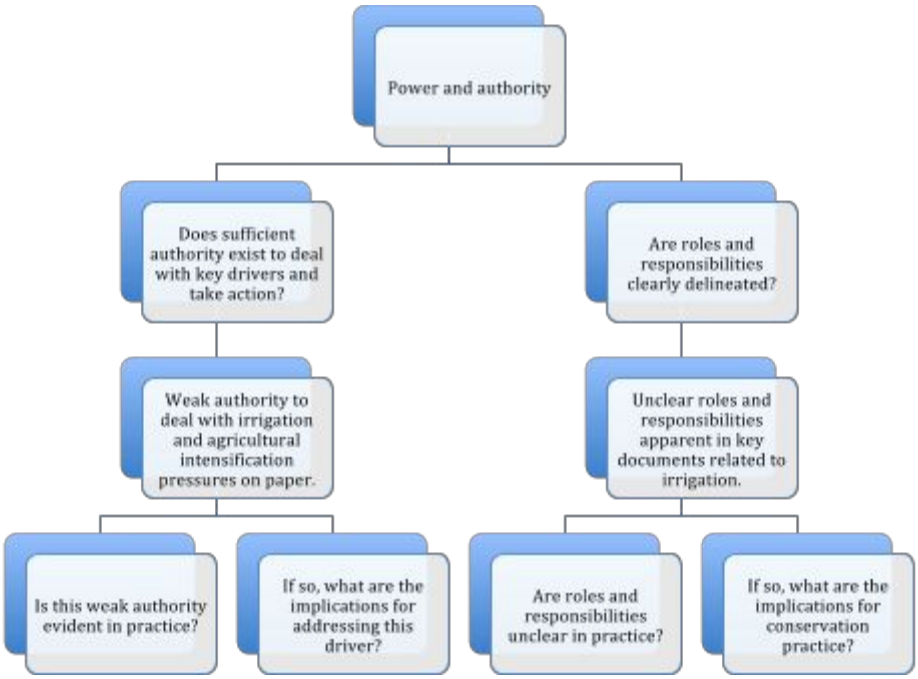
Supplementary Material

Supplementary Table: Diagnostic questions for applying the framework

Framework Component	Initial diagnostic questions
Problem and players	
Framing: Understanding the biodiversity conservation agenda, nature of the problem, and the range of solutions.	● How is biodiversity conservation currently approached in this landscape and at what scale? ● What (and who) is contributing to biodiversity decline? Who can help solve it? ● What solutions have been employed and how have they worked?
Culture and norms: Both influence behaviour by 'defining' what is proper and improper behaviour.	● How does organisational culture influence policy and its implementation? ● What are the norms influencing decisions to participate (or not participate) in biodiversity conservation?
Politics	
Interplay: Institutions interact across governance levels and geographic scales. Biodiversity institutions also interact with other institutions (e.g. economics, agriculture).	● How do approaches to conserving biodiversity influence each other? ● How do the different levels of governance interact? ● How do politics influence practice at each level? ● How do institutions in other areas interact with biodiversity conservation?
Power and authority: Institutions empower individuals and organisations to act and cooperate. Authority to conserve biodiversity provides an important safety net.	● How is power distributed between individuals and organisations? ● Does sufficient authority exist to deal with key drivers and take action? Where does it exist? ● Are roles and responsibilities clearly delineated?
Practices – competence	
Cooperation: Biodiversity attributes and threats occur across properties, tenures and jurisdictions, requiring cooperation between actors and across scales and governance levels.	● What is the current level of cooperation? ● Are there particular areas or objectives requiring greater cooperation? ● What conditions are hindering efforts to cooperate?
Administrative competence: Knowledge, capability, and the commensurate resources and competencies are necessary to achieving conservation objectives.	● Do individuals and organisations have the necessary human resources? (e.g. skills, knowledge, quantity and quality of employees) ● Do individuals and organisations have the necessary financial resources? ● How well do policies on paper match the problem of biodiversity conservation in practice in this landscape?
Learning: A process of adjusting goals and approaches in response to experience and information. It can enable change and sustain practices.	● How do individuals and organisations get feedback on current approaches? (e.g. monitoring practices, sources of information) ● Do individuals and organisations reflect on current practices, and adjust in response?
Practices – capacity	

Leadership and entrepreneurship: Leadership can be structural, entrepreneurial and intellectual. It can come from any level of governance.	● Who is taking the lead on biodiversity conservation, and how are they influencing outcomes and practices? ● Are there individuals and organisations adopting innovative approaches to policy or management? ● Are there factors constraining leadership capacity?
Buffering: Institutions must recognize thresholds and disturbances and respond to buffer ecosystems. Organizations need to buffer against changes in external environments to achieve objectives over the long term.	● Are there multiple institutions and organisations addressing biodiversity conservation? ● Are there multiple approaches to addressing biodiversity decline in this landscape, or are most resources devoted to only one or two? ● How do organisations cope with external factors, like political influence and budget cuts?
Self-organizing: Self-organizing networks can build institutional memory, fill gaps in formal responsibilities, and provide capacity.	● Are individuals and organisations empowered to self-organise and act locally? ● Are there informal and formal networks for sharing information and making decisions?



Supplementary figure: Example of interaction between steps 3 and 4*

* Refer to Clement *et al.* 2015b for description of methods and results.